

# Fabrication of Electric Folding Triscooter/Tricycle

Manisha Bhadade

Department of Mechanical Engineering, Manoharbhair Patel Institute of Engineering and Technology,  
Shahapur, Bhandara, Maharashtra, India

## ABSTRACT

The basic aim behind our project was to make an environmental friendly portable automobile that would be easy to handle by both the sexes and would emit 0% emission. We have used D.C motor as our main electric source due to which there is no emission at all and also the problem of fuel consumption is solved. Also keeping in mind the parking problems now days, we decided to make a triscooter which can be folded easily, so after the use one can fold the triscooter and can carry it along with him/her. Our design allows users to easily transport the triscooter using less space when it is "folded" into a compact size. We have made this design with our own innovative ideas and by referring some books and websites. Our project is unique and no foldable triscooter is available in Indian market till now.

**Key words:** Electric scooter, electrical motor, efficiency, fabrication, portable, environment friendly, economic, no emission.

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## INTRODUCTION

Main aim of our project was to design a portable automobile which should be very easy to carry as well as easy to handle by both the sexes with equal ease. The aim was also that it should be environmental friendly and should be non-polluting. Scooters are a subclass of motorcycles and are very popular as transportation in urban and rural areas. Some types of scooters that we will find zooming up and down the highways and city streets. The user can tread the pedal of the tread board successively to move the scooter forward. Generally, there are several types of scooter operation. High electric scooter usually uses a small engine with gasoline and sometimes electrical motors.

In 1960s and 1970s saw a need of an alternative fueled vehicle to reduce the problems of exhaust emission from internal combustion engines and to reduce the dependency on imported foreign crude oil. During this year from 1960 to the present many attempts to produce practical electric vehicles occurred and continue to occur. The first EV was built in 1895 by A L Ryker and William Morrison. Electric vehicles are considered to be 97% cleaner, producing no tailpipe emission that can place particulate matter into the atmosphere by gas-electriced vehicles can increase asthma condition as well as irritate respiratory systems while EV does not create any such problems.

## CONCEPT OF MODEL

The concept of model taken from children's scooter bicycle the complete body looks like a scooter bicycle in which platform is provided for standing and driving the electric scooter. This product is a small electric electrical motor, used

for various purposes. It is economical in electricity consumption; scooter can be driven comfortably with the help of streamline design of the body. It has compact structure and aesthetic shape.

## Types of Scooter

**Different types of scooters are as follows:**

- A. Gas scooter -The speed of these scooters can be stepped up to levels that cannot be achieved in case of other types of scooters. These scooters are also available in different sizes and weights depending on the gas tank.
- B. Electric Scooters - An electric scooter is a battery-operated one-person capacity vehicle. Usually, it uses DC electric motor for its operation. It may have three wheels or four and also does not create pollution.
- C. Mobility Scooter -This is a modified version of the electric scooter and is made for special people like the disabled and the aged people. These scooters are extremely stable, as they have more than two wheels. Some even have four wheels.
- D. Foldable Scooter - This kind of scooter made to be small space storage and easy to bring from one place to another place. Either use electric source or kick power moving.
- E. Utility Scooter -The utility scooters are extremely handy and are used for a wide range of purposes. This variety serves multiple purposes.
- F. Retro Scooter- Based on modification from classic scooter like Vespa. It refers to how much a design adheres to the original Vespa.

- G. Chopper Scooter -Many scooters available come in bodywork that rests on a tubular frame. Because of this, it is relatively easy to modify and give the appearance of small Harley chopper motorcycles. Because of their appearance, it is called chopper scooters.

## OBJECTIVE

- A. Folding ease: Folding should be easy, stress-free, and take no more than 10 minutes after user becomes familiar with the tri-scooter.
- B. Portability: It should be easily transportable for both women and men. It should be easy to handle and should be portable.
- C. Reliability: It should have a stable ride, confident feel, and similar performance to a conventional bike. Fit various sized people, should be easy to maintain and reliable.
- D. Retailer Network: Program should offer two to three price points such as a „good, better and best“ philosophy. Sales and service should be very convenient and available to users via local retailer networks.
- E. To design and fabricate electric vehicle.
- F. To increase electric vehicle feasibility by folding.
- G. To reduce the emissions by Mechatronics technology.

## PRECEDING RESEARCH

- A. FU Aia (Ms.), Market Analyst, Beijing, China-“The Role of Electric Two-Wheelers in Sustainable Urban Transport in China” Investigation has been done on Battery and motor improvement. Furthermore, manufacturers are also encouraged to explore new internal components for Li-ion batteries like Lithium iron or fuel batteries to enable an early adoption, thus upgrading the industry to be more competitive and greener.
- B. Aditya Ganjapure, Palsh Kawale, Mangesh Deshpande, et al-“Design and development of compact three wheeled foldable electric moped.” Investigation has been done on electric moped drive by BLDC Hub motor having efficiency 84%. As seen in this report, with 18 km range on a single charge, a top speed of 13 kmph and an ability to fold small enough to fit next to you in train or a bus, it can act as an awesome last kilometre commuter vehicle also it is great way of transport for short distance and crowded areas.
- C. Sasank Sekhar Panda<sup>1</sup>, Nirmal Bhargava, et al-“Design and Fabrication of Electric Scooter.” It is specially designed for those who having difficulty in moving or walking frequently from one place to another. An electric scooter is different from a wheelchair which is motorized, and is generally used for indoor use and usually costs a great deal more.
- D. Sachin T. Achari, Nikhil P. Tambe, et al- “Design and Fabrication of Foldable Tri-Scooter.” Folding should be easy, stress-free, and take no more than 10 minutes after user becomes familiar with the tri-scooter. The running cost of the vehicle is approx. less than a rupee per kilometer as the electric source is on electricity. The vehicle can run on an average of 7-8 km on a single charge.
- E. Arthur J. Petron - “The Folding Roboscooter: Structural Analysis for an Electric Scooter used in Urban Conditions.” The front fork and main pivot are focused on in this analysis because they experience the largest

forces during riding. PCM absorbs and release heat at a nearly constant temperature. They store 5-14 times more heat per unit volume than sensible storage materials such as water, masonry, or rock.

- F. D. M. Sousa P. J. Costa Branco J. A. et al- “Electric Bicycle Using Batteries and Supercapacitor”. They investigate electric converters. In this paper an electronic converter using two electric sources connected through two DC-DC converters is described having potential application in electric bicycles or in other vehicles for individual use without internal combustion engines.
- G. Mark Johnson Folding scooter- a folding scooter has an upright handlebar position, suitable for riding the scooter, and a folded handlebar position, suitable for storing the scooter. The folding scooter features a base, a handlebar shaft having locking hinge plates, and a base shaft having a lower locking hinge plate. The locking hinge plates of the handlebar shaft rotate with respect to the lower locking hinge plate as the handlebar shaft moves from the upright position to the folded position. A locking mechanism has a first locked position when the handlebar shaft is in the upright position and a second locked position when the handlebar shaft is in the folded position.
- H. Ching Chiuan Chen- Scooter having a safety folding mechanism, a scooter includes a base having a rear wheel and having a block secured to the front portion. A tube is rotatable, engaged on a handlebar and includes an arm pivotally secured to the block and having one or more oblong holes for receiving a rod. A spring may bias the rod to engage with a groove of the block and to secure the handlebar to the base at an open working position.
- I. Paul Atherton, Andrew Graham, Kurt Walas-Electrified foldable scooter a scooter has a platform on which a rider can stand, a front wheel attached to a steering system including an upstanding handle bar and rear wheel which is driven. The scooter can be folded at a hinge line across the platform so to allow it to collapse. A case for the scooter includes a front part and a rear part covering the front and rear wheels with the parts brought together by the collapsing of the platform. This folding action also uses a pivot link to move the front and rear wheels pivoted within the respective case parts to a folded position. The steering includes a headstock with the steering bar connected to the front fork by a drive coupling which converts the rotation of the steering bar about the generally vertical axis to the rotation of the fork about an inclined axis.

## COMPONENTS

“FOLDABLE TRISCOOTER” is the electrically operated consisting of the following different sub-components:- D.C. Motor, Frame, Charger, Battery, Wheels, Drive, Tricycle.

- A. D.C. Motor: The motor is having 250 watt capacity with maximum 800 rpm with torque capacity of 50 Nm. A stepper motor is a unique type of DC motor that rotates in fixed steps of a certain number of degrees. Geared DC motors can be defined as an extension of DC motor. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM.

Geared DC motors can be defined as an extension of DC motor. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM. The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. Gear motor adds mechanical gears to alter the speed/torque of the motor for an application. Usually such an addition is to reduce speed and increase torque. Its specifications are as per the following:-

- Current rating - 14 Ampere
- Voltage rating - 24 volts D.C.
- Cooling - air cooled
- Bearing - single row ball



**Figure2. D. C. Motor**

- B. **Controller:** The motor controller is an important component of the system. It is essential to control the amount of power supplied and to drive the DC motor. The controller converts the DC voltage from battery to an alternating voltage with variable amplitude and frequency that drive the motor at different speeds. It basically consists of MOSFET transistors and small microprocessor that vary from detecting any malfunctions, the throttle to protect functions against excessive current and under-voltage, which are ideal for protecting the system.



**Figure3.Controller**

- C. **Battery:** Lithium ion battery is a type of the rechargeable battery in which lithium ions move from the negative electrode to the positive electrode during discharge and back when charging.



**Figure4.Battery**

- D. **Throttle/Accelerator:** The maximum speed of a bicycle is 25 km/h. It is required to vary the speed depending upon the road conditions & traffic. Therefore an accelerator or a throttle is necessary. Throttle allows us to drive the motor from zero speed to full speed. The throttle is fitted on right side of the handle bar and is connected to controller.



**Figure5.Throttle**

- E. **Chain Drive:** A Chain is an array of links held together with each other with the help of steel pins. This type of arrangement makes a chain more enduring, long lasting and better way of transmitting rotary motion from one gear to another. The major advantage of chain drive over traditional gear is that, the chain drive can transmit rotary motion with the help of two gears and a chain over a distance whereas in traditional many gears must be arranged in a mesh in order to transmit motion.



**Figure6. Chain Drive**

- F. **Freewheel (Sprocket):** A freewheel consists of either a single sprocket or a set of sprockets mounted on a body which contains an internal ratcheting mechanism and mounts on a threaded hub. Threaded rear hubs were available in different thread patterns depending on the country of manufacture, French and British threads being the most common.



**Figure 7. Sprocket**

- G. **Mechanical Brakes:** Mechanical brakes are assemblies consisting of mechanical elements for the slowing or stopping of shafts in equipment drives. They use levers or linkages to transmit force from one point to another. Braking slows or stops the movement of the couple shafts.



**Figure8. Mechanical Brake**

#### FORMULA TO BE USED

##### Abbreviation:

- $d$  = diameter of the cycle rim in meters.
- $r$  = radius of cycle rim in meters.
- $\omega$  = Angular velocity of cycle shaft.
- $N$  = Speed of cycle wheel in RPM
- $v$  = Linear velocity of the cycle in km/s
- $N_1$  = Normal reaction of the road on each tire in Newton.
- $\mu$  = Coefficient of friction = 0.3
- $F$  = Frictional force between tire and road in Newton.



T= Torque developed on the shaft due to frictional force in Newton-meters.

P= Power required to ride the cycle in Watts.

t= time required to charge the battery by A- C Supply in hours

Friction Force Acting On the Tyre

$F = \mu N_1$

Torque Required

$T = F \times r$

Speed Calculations

$\omega = v \div r$

$\omega = (2 \pi N) \div 60$

$N_1 = (60 \times \omega) \div (2\pi)$

Power Calculations

$P = (2 \pi N T) \div 60$

### Battery Specification

Power = Voltage x Current

$P = V.I$

### ADVANTAGES

1. Easy to handle by both the sexes.
2. It travels a kilometer less than a rupee.
3. Portable and compact.
4. No pollution, it emits 0% emission.
5. It is environmental friendly.

### DISADVANTAGES

1. It is heavy as the material used is mild steel.
2. Battery charging takes more time.
3. Small tires so easy wear and tear.

### CONCLUSION

Foldable triscooter has an ability to fold small enough to fit next to you in a train or a bus, it can act as an awesome last commuter vehicle and also it is great way of transport for short distance and crowdie areas. It has many beneficial features such as folding mechanism, shock-absorbing seat for an extremely comfortable ride, three wheels for more stability and disk brakes for better bracking performance. The electric moped has many advantages and it is cleaner and much moe efficient. Electric mopeds also eliminate the dependacy of foreign imported crude oil hence helps in developing the economy of the country. Compared to the foldable triscooter existing in the market, our triscooter is economic & occupies less space. The weight of our triscooter less than other triscooter available in market through the material used is mild steel. The evaluation results suggest that electric scooter use is appropriate in closed

environments, such as major industrial complexes, hospitals, shopping centers and airports. The reliability and safety of this device when used in urban communities; Social acceptance of electric scooters help to reduce traffic problem. In future we can use flexible sitting arrangement also we can use advance braking and suspension It also produces zero tailpipe emissions hence reduce the health hazards like cancer, asthma and various other respiratory problems. The design of the foldable tri-scooter is based on the standard data available system.

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Figure1. Electric Folding Tricycle/ Triscooter